Information Commons and eScience, Unesco, Paris

1-2 September 2005

Transforming eScience to inclusive science:

Open access is the key

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Inaugurating a micro-credit programme in a village in southern India, Prof. Bruce Alberts told the villagers that he had come all the way from Washington DC to support such a programme because he would like his grandchildren back home to live happily and in peace when they grew up. Indeed he has so far visited our project villages four times in the past six years.

If there are great disparities in the world, no one can hope to live in peace.

And the economic disparity between developed and developing countries is indeed great and it continues to grow.

- The assets of the world's three richest people are greater than the combined GDP of the 49 least developed nations.
- The GNP of 80% of the world's population continues to remain low, while the wealth of the affluent 20% is increasing.
- Over the last twenty years the gap between the twenty richest countries in the world and the sixty poorest countries has been growing at a rate of about two percent per year.
- **This divergence is something very big and very serious.**

Such gaping wealth inequalities tend to breed discontent. If we turn a blind eye to persistent poverty, hunger and malnutrition, we may have to collectively pay a price in the form of mass unrest and terrorism.

While poverty is first and foremost a moral issue, it is a pressing security issue as well.

Photo Courtesy: Time

Recent experience has shown that SARS and avian flu take just three or four days to reach North America from East Asia and probably less than that to reach Europe.

Natural disasters such as tsunami affect people in far continents. Sea level rise, the ozone hole and climate change will affect the entire globe.

It must be clear, if ever there were any doubts, all of us humans live in an interdependent global village. If people, wherever they are, cannot respond quickly to epidemics and natural disasters, the chances are any of us can be affected.

The best way to address these problems is through the application of science, and science performed not just in a few advanced countries but everywhere.

Said Jawaharlal Nehru: “It is science alone that can solve the problems of hunger and poverty, insanitation and illiteracy, of superstition and deadening custom and tradition, of vast resources running to waste, of a rich country inhabited by starving people…Who indeed could afford to ignore science today? At every turn we have to seek its aid…the future belongs to science and to those who make friends with science.”

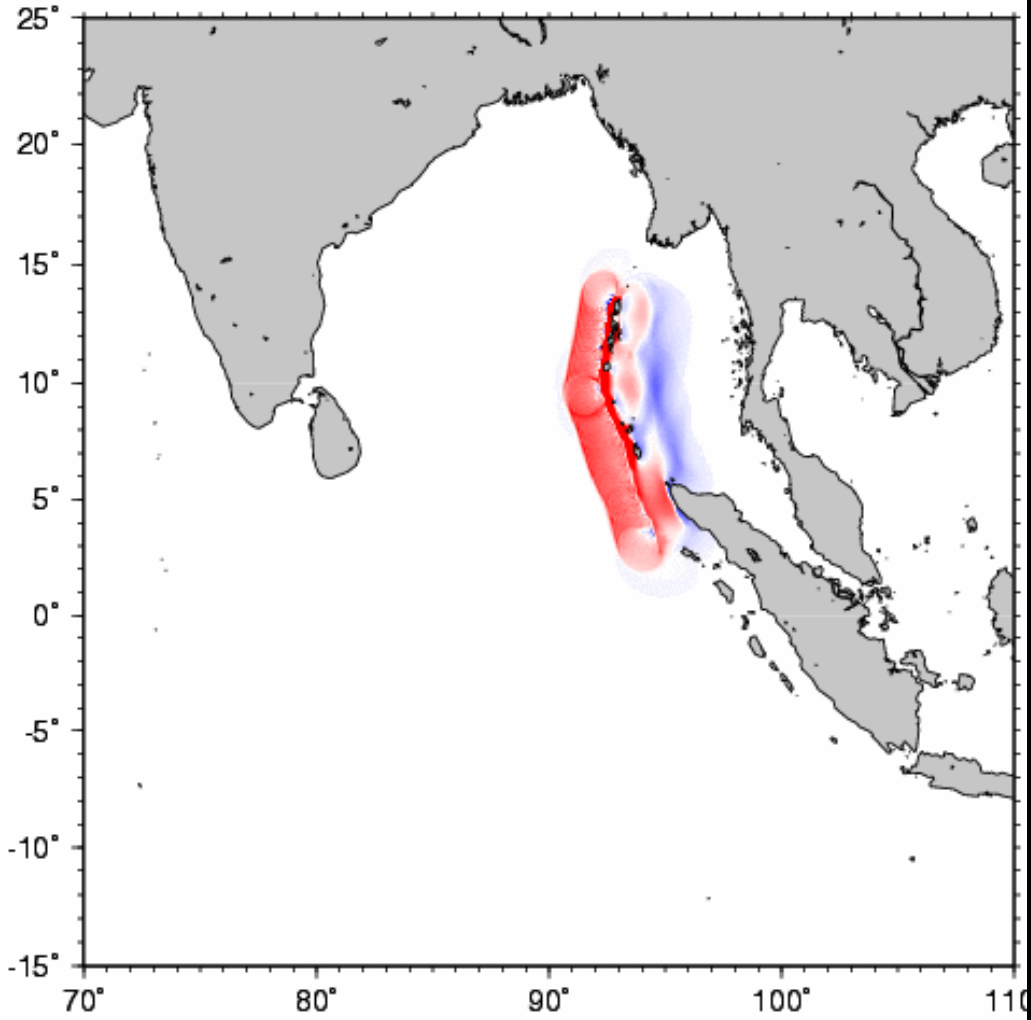
The recent decades have seen the emergence of vast amounts of new knowledge and technical opportunities. Unfortunately, modern science and technology which played a crucial role in making the developed world what it is today have not made the same kind of impact on the countries which came in late. Most of the developing countries are not only far from being able to participate in the ‘blessings’ of modern life, but are also suffering from its ‘curses.’

If science were to play a role in reducing the disparities among nations, then it is essential to reduce the imbalance in the capacities of the most advanced and the most disadvantaged nations to conduct research. Ultimately, development depends on the capacity of a nation to steer its development in the desired direction. Until poorer countries are able to build up their own capacities and infrastructure they are going to continue to be marginalized . A vital part of this capacity is the ability of a nation to absorb, develop and apply knowledge or, in other words, be able to perform scientific research in areas of relevance.

Said Bruce Alberts after the September 11 tragedy, “We now know for certain that, if our grandchildren are to live in an open, free society and not inside a walled fortress, we must devote even more energy to using science and scientific values to ensure the safety, stability and productive development of peaceful democratic nations throughout the world.”

There are other reasons for developing countries to pursue science. As there is a growing tendency to privatize science, issues of great social importance (such as health research related to malaria, diarrhoeal diseases, etc.) remain neglected because they have little commercial potential.

Without free and unhindered flow of information, it will be difficult to perform science let alone maximize the efficiency (and the benefits) of scientific research.



"We have not only lost lives, but also our livelihood. It may take months, perhaps years for us to recover. Our future is totally dark." – Fishermen at Periayakalapet

The power of access to information was amply in evidence during the recent tsunami tragedy, when wherever people were exposed to a culture of information they were able to cope with the tsunami better.

Researchers in most developing countries are working under very difficult conditions, especially in regard to information access. To do research, they need access to essential global research findings, but they do not have such access. For example, in the 75 countries with a GNP per capita per year of less than $1,000, 56% of medical institutions have had no subscriptions to journals over the last five years; in countries with a GNP between $ 1–3 thousand, 34% have no subscriptions and a further 34% have an average 2 subscriptions per year. What kind of research is possible in these institutions?

Eight countries, led by the USA, produce almost 85% of the world's most cited publications, while 163 other countries account for less than 2.5%

As long as this asymmetry in research output and access to relevant information persists, scientists in developing countries will remain isolated and their research will continue to have little impact.

Advanced country scientists also need information generated in developing countries, for without the input of knowledge from the disadvantaged regions, development initiatives may suffer from inappropriate programmes. Take for example tuberculosis research. It is known that *Mycobacterium tuberculosis* isolates from India show different copies of certain sequences (IS6110 and H3VRv) from isolates taken in the West, and different again from those isolated in China, so the BCG vaccine developed in the West has reduced efficiency. Similarly, in diabetes, what works in the UK may not work in India, as environmental and genetic factors play a part.

The Internet and Web technologies can help improve two-way flow of information. They have the potential to democratize access to information (and facilitate collaboration) be it for scientific research or for rural development.

Both China and South Korea have shown that it is possible for a country to lift itself up from a scientific nobody to a world-class performer in a decade or two.

Number of papers published by China and South Korea

Year	CHINA	S.KOREA
1981-85	2,146	-
2000	30,509	14,629
2001	35,392	17,343
2002	40,749	18,421
2003	49,790	22,958
2004	57,378	24,464

Data obtained from *Web of Science – SCI Expanded*, except for 1981-85 for which the numbers were obtained from the print edition of *SCI*.

Other developing countries will do well to follow their footsteps, but they need favourable conditions – one of which is the creation of a worldwide information commons for science. Fortunately, we have the technologies to create it and they do not cost much.

Thousands of books (e.g. the Million Books projects of India and China, Project Gutenberg) and reports (e.g. all reports of the US National Academies), courseware (e.g. MIT), and data sets (especially in the emerging areas of biotechnology and bioinformatics) are available free for viewing and downloading.

What we need is to make new research findings freely available. About 2,000 STM journals are available free for viewing and downloading. Already there are more than 500 institutional archives and these store more than five million papers. But, what has been achieved so far is only a fraction of what could be achieved. Ideally, all research output should be available to all researchers.

International organizations such as the WHO and the FAO have mounted some initiatives (HINARI, AGORA) to help scientists in developing countries access literature published in commercial journals. If they had invested some of their time and energy on promoting self archiving by scientists around the world, the results would have been far better.

It is worth recalling what Bruce Alberts had said: “I learned to my surprise that most of the international organizations established by the United Nations with the great hope of using science and technology to improve the human condition are seriously hampered by bureaucracy and a lack of energy, innovation, and resources.”

It is important that universities and research institutions in both the advanced countries and the developing countries make their publications available to the world through open access archiving. Only then developing country researchers can access information which at present is only accessible through toll-access journals. Making papers open access will enhance their visibility and impact. Such repositories will facilitate eScience to transform what is now an activity of an elitist club of rich nations into inclusive science.

Even if all the content is available via OA archives, in many countries scientists do not yet have access to the Internet. As suggested by Bruce Alberts, we must connect all scientists to the World Wide Web, where necessary, by providing subsidized Internet access. Some donor agencies such as SIDA are willing to fund Internet access to partner institutions in developing countries. In any case, fortunately, the costs of equipment and connectivity charges are coming down.

Widespread free access to the literature can also help transform the current 'safari' kind of research into true collaboration with poor countries, especially in areas such as ethnobotany and drug development for combating diseases such as malaria and tuberculosis.

Conclusion

Disparities among nations are increasing and that can lead to disharmony. Poor countries need to achieve better standards of living.

Epidemics and natural calamities, when they occur, tend to have impact far beyond where they occur.

It is important to harness science to tackle both these problems. It is necessary for disadvantaged countries to develop research capacity.

Research cannot be done without access to relevant information.

Conclusion

Thanks to advances in Internet and World Wide Web, it is now possible to make information available to all at a very low cost.

Already there are examples of research papers, STM journals, books, reports, doctoral dissertations and scientific data and databases being made freely available on the Net through open access. And open access is winning the support of leading institutions and donor agencies. Taking advantage of the momentum gained already, we should extend open access to cover a much larger volume of useful content, particularly through open access archiving.

Conclusion

Where necessary (especially in Sub-Saharan Africa), the provision of OA content should be complemented with the provision of subsidized Internet access.

It is not enough if the rich nations stop with debt relief, increased aid and fairer trade policies; the best way to help the poor nations is to help them become self-supporting through strengthening science in those countries and there is no better means to do that than through adopting the public commons approach to information sharing and through forming genuinely productive research partnerships.